This course will give an introduction to the theory of infinite-dimensional Lie algebras and their representations, with an emphasis on affine Lie algebras.

Kac-Moody algebras are an infinite-dimensional generalization of finite-dimensional complex semi-simple Lie algebras. They are defined by generators and relations, have a triangular decomposition, and have a well-behaved class of representations.

Affine Lie algebras are the most studied infinite-dimensional Kac-Moody algebras. They encode the symmetries of a class of 2-dimensional conformal field theories, play a central role in the geometric Langlands program, in the representation theory of algebraic groups in positive characteristic and in combinatorial identities and modular properties of generalizations of Jacobi’s triple product identity.

Topics to be discussed:
- Virasoro algebra
- Kac-Moody algebras, root systems, Weyl groups
- Affine Lie algebras, central extensions, Sugawara construction
- Representation theory, character formula, applications

Prerequisites
210ABC

References

Office hours M 1-2pm, W 9-10am or by appointment.

Grading
The course assessment will be based on a 20mn presentation. The presentations will be held during the weeks of November 27 and December 4.
A list of possible projects will be provided on Monday October 23 and a preferred choice, as well as a second and third choice, will need to be sent to me by email by Wednesday October 25. You may also suggest your own topic, which I will need to approve.
An abstract of what you plan to do for your presentation will be due on Wednesday November 8.